

Neurodevelopmental, molecular, and behavioral effects of child maltreatment: **And why this is important to you**

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“There can be no keener revelation of a society’s soul than the way in which it treats its children.” – *Nelson Mandela*



Effects of abuse and neglect

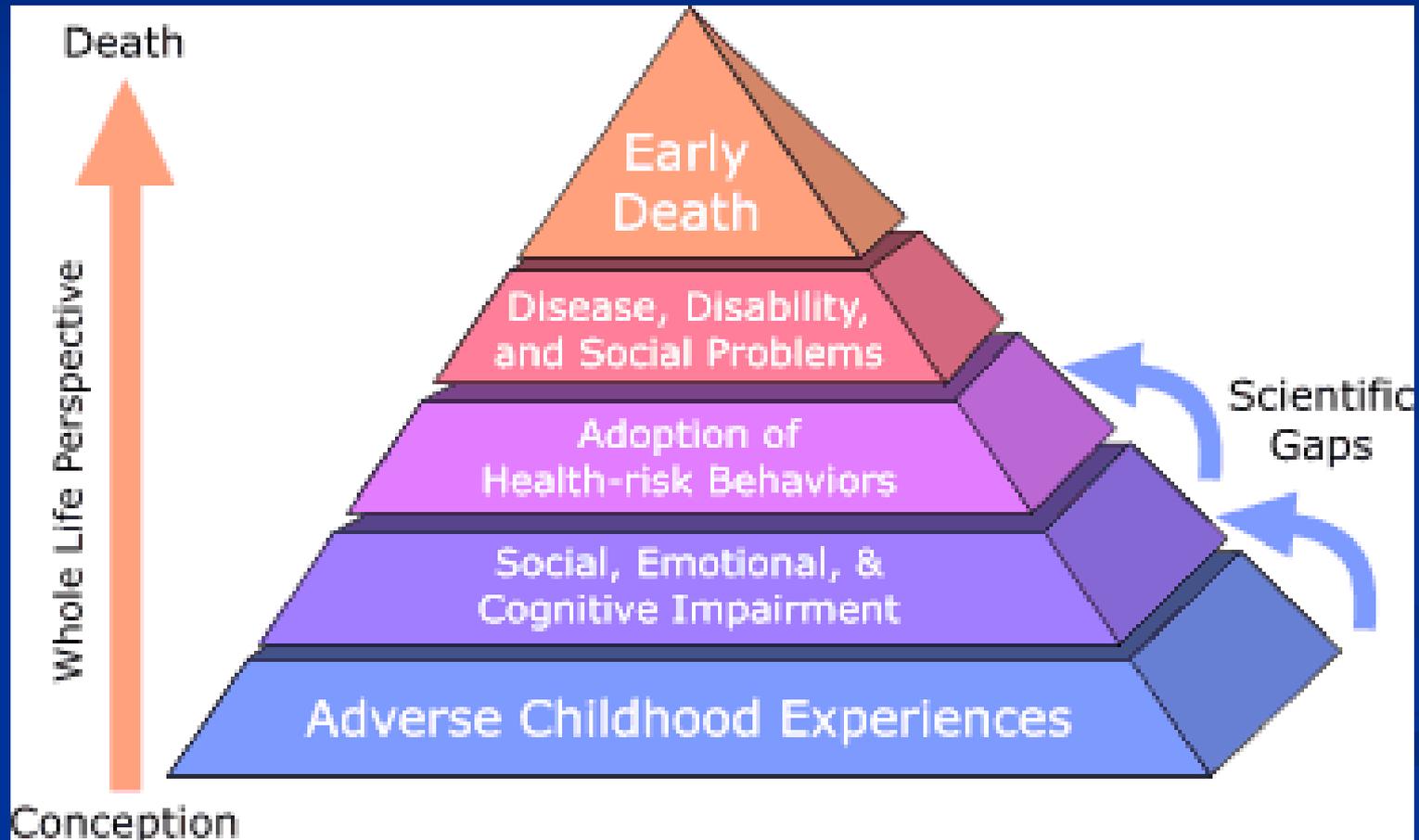
Effects of abuse and neglect

- **Physical consequences**
 - Ranges from no significant injury, short term disability, long term disability, permanent disability, death
- **Social consequences**
 - Family disruption, legal & social interventions
- **Behavioral and neuroendocrine consequences**
 - The most significant consequences

Consequences of abuse and neglect

- Trauma is cumulative, dose related
- Trauma early in life effects attachment, emotional regulation, impulse control
- Abused children have lower social competence, have less empathy, can't recognize their own emotions, can't recognize other's emotions
- Abused and neglected children are at increased risk of adverse health effects and behaviors as adults including physical , psychological, social issues

Adverse Childhood Experiences (ACE) Study



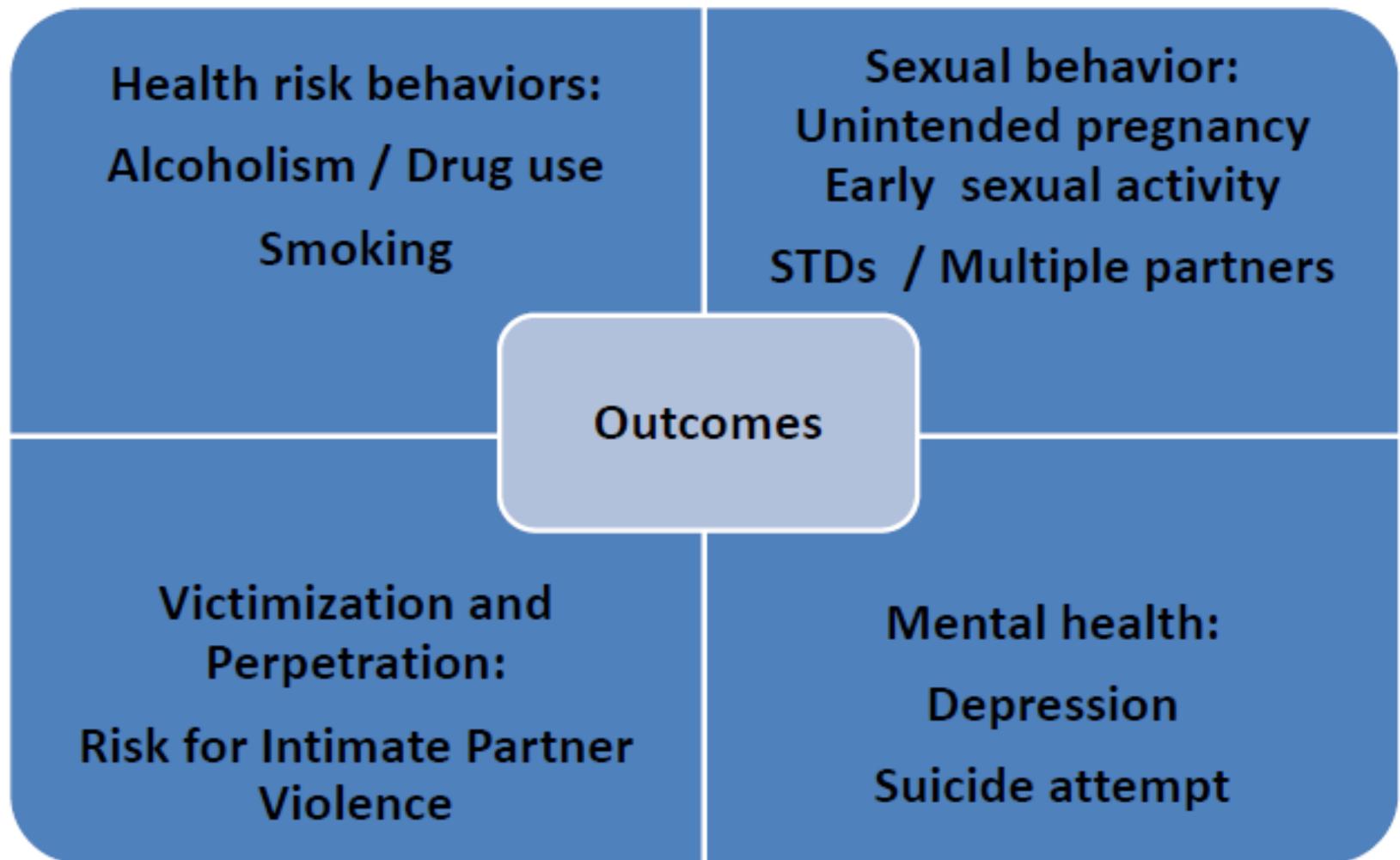
Adverse Childhood Events are Common

- Emotional abuse
- Physical abuse
- Sexual abuse
- Emotional neglect
- Mother treated violently
- Household substance abuse
- Household mental illness
- Parental separation or divorce
- Incarcerated household member

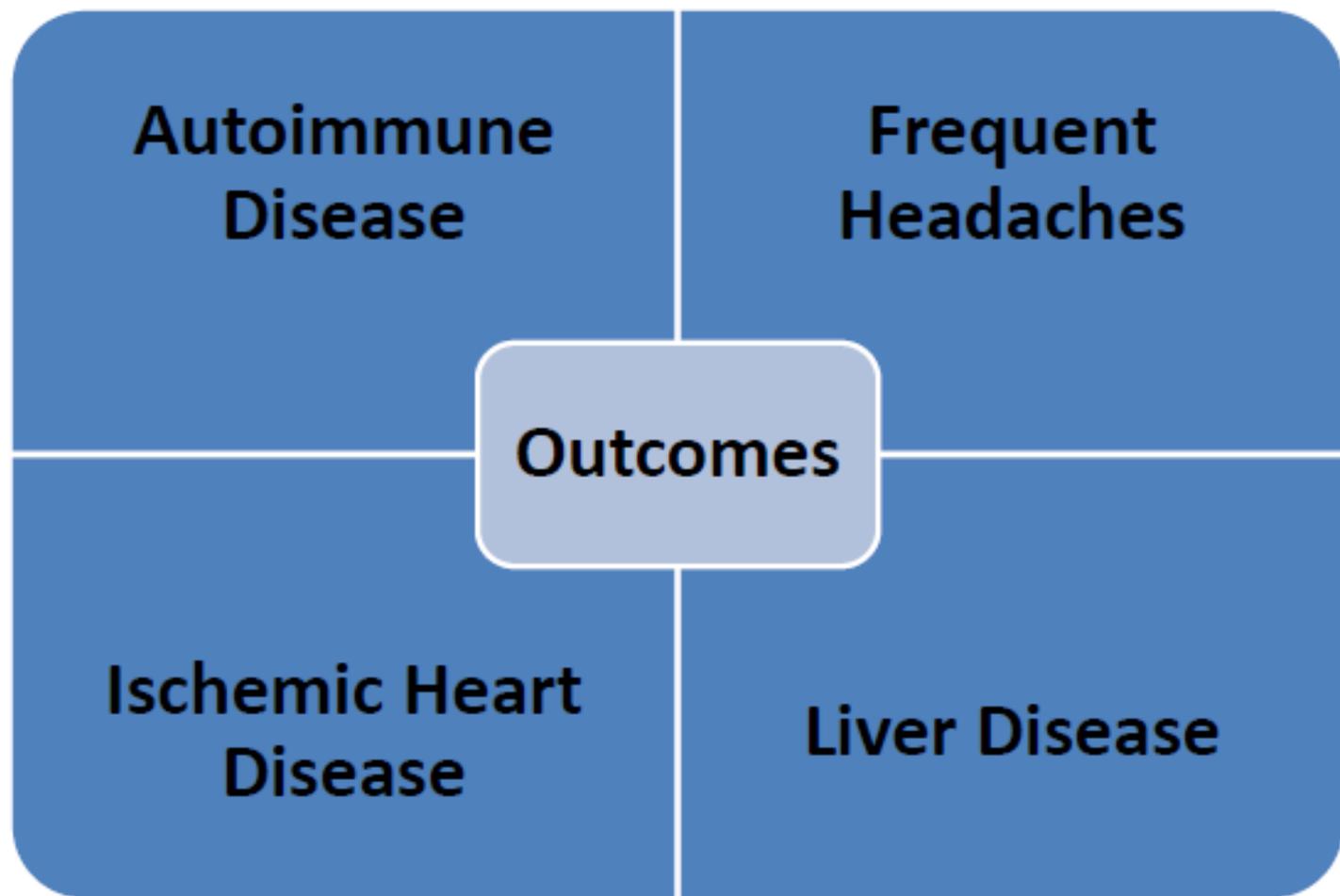
2/3 of study
participants reported
at least one ACE

1/5 reported
3 or more ACEs

ACEs and Health Outcomes:

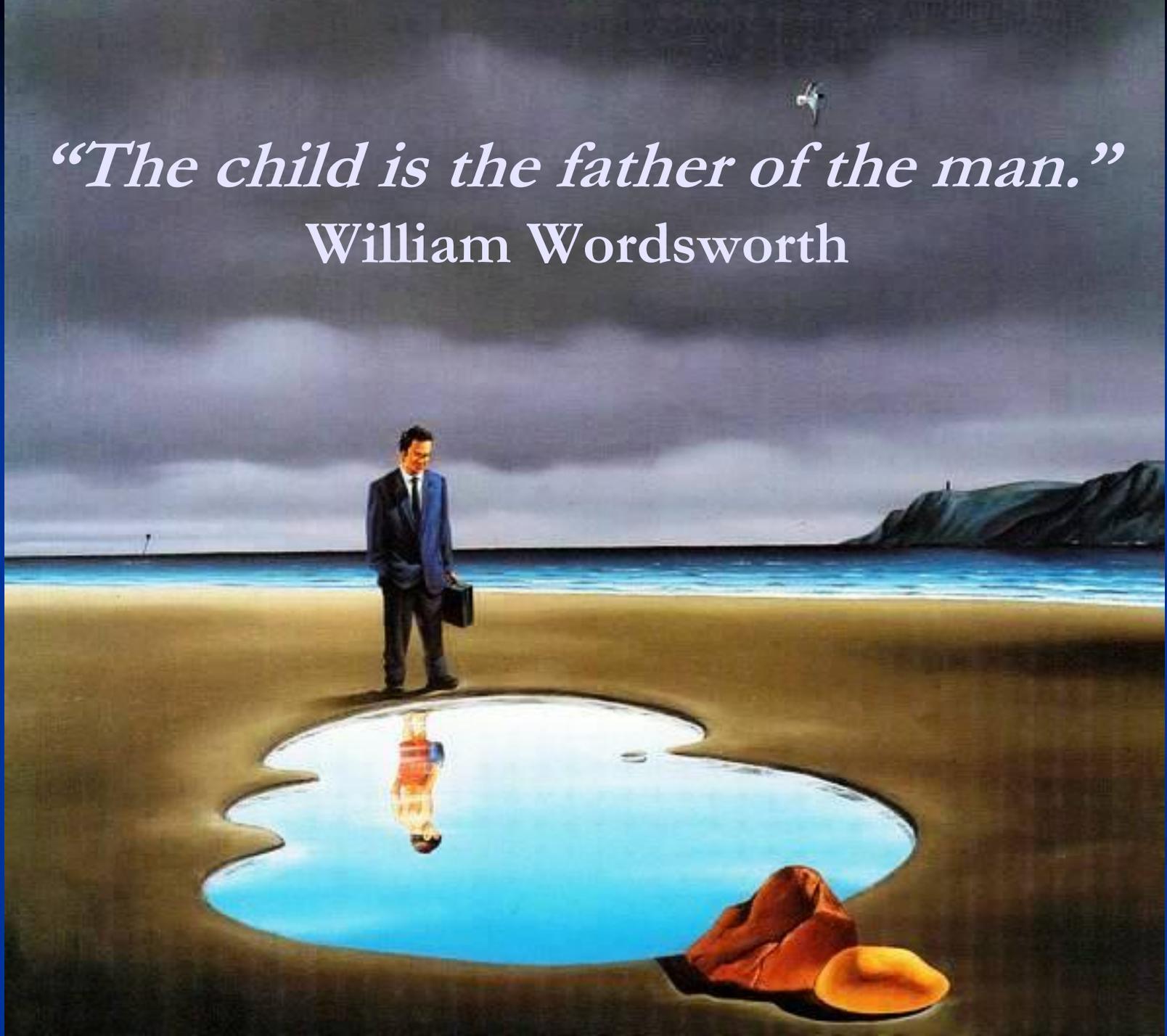


ACEs and Health Outcomes:



“The child is the father of the man.”

William Wordsworth



Child Traumatic Stress

- *Physical and emotional responses* of a child to events that threaten the life or physical integrity of the child or of someone critically important to the child (such as a parent or sibling).
- Traumatic events overwhelm a child's capacity to cope and elicit feelings of terror, powerlessness, and out-of-control physiological arousal.

Traumatic Stress may be:

- *Acute: a single traumatic event*
 - Natural disasters, illness, accidents...
- *Chronic: recurring or cumulative traumas*
 - Abuse, neglect, war...
- *Complex Trauma refers to traumatic stress that results in longstanding physiologic change*

Three Categories of Stress Experiences

Positive

Brief increases in heart rate,
mild elevations in stress hormone levels.

Tolerable

Serious, temporary stress responses,
buffered by supportive relationships.

Toxic

Prolonged activation of stress response systems
in the absence of protective relationships.

Child abuse and neglect are sources of traumatic stress.

Traumatic stress becomes toxic stress when it makes persisting changes in the way our bodies respond to stress.

Children are most susceptible to these changes.

Toxic stress produces changes in multiple body systems.

Systems



- **Molecular**

Genetics and epigenetics

- **Neuroendocrine**

Cortical volume, neural connections

Levels of stress hormones,
neurotransmitters

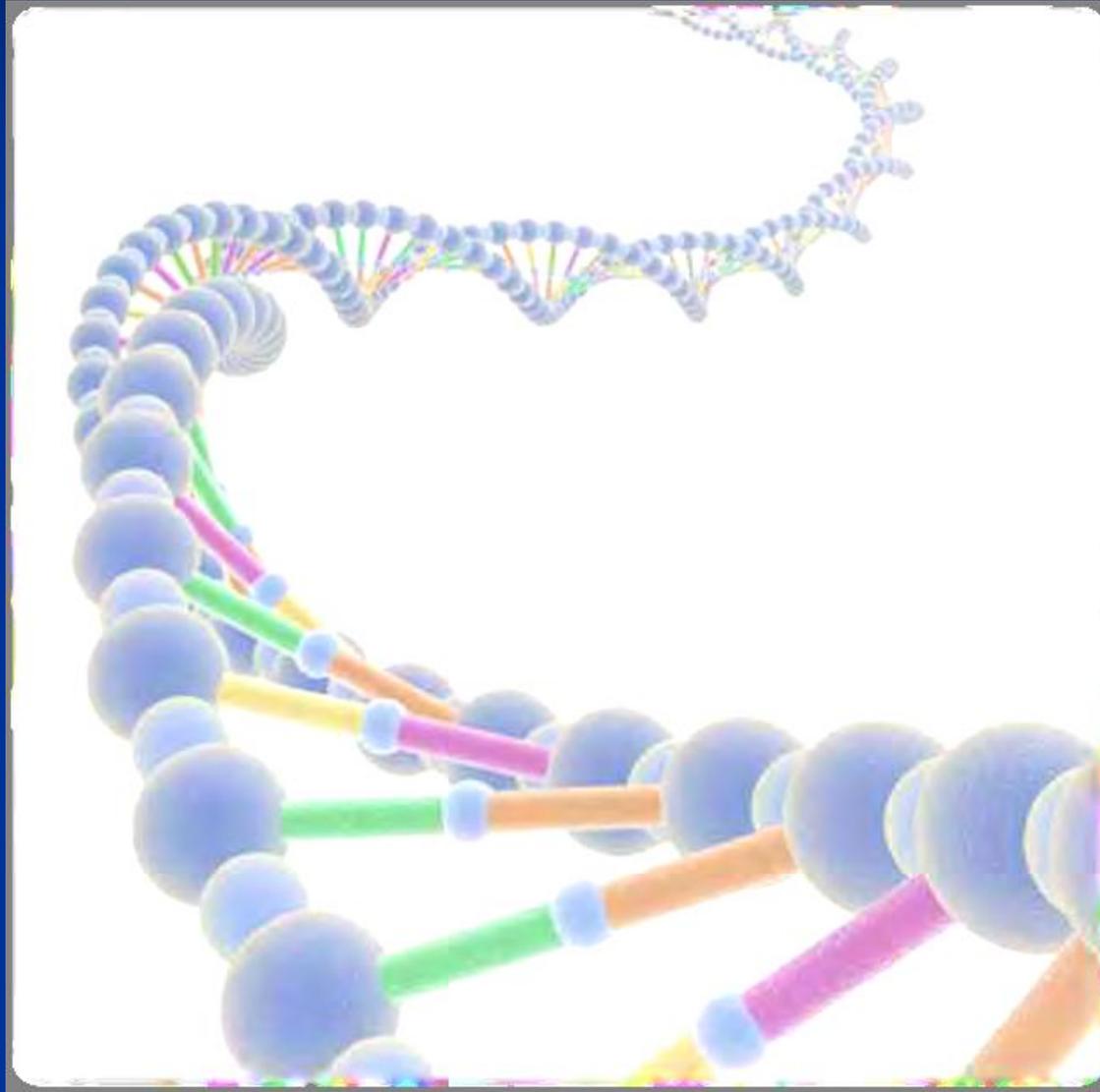


- **Social/Behavioral**

Mood, sociability, belligerence



SYSTEM – Molecular Genetic/Epigenetic



Genetics

- **What genes do**
 - Contain DNA “instruction sheets” for building proteins
 - Which are read or “transcribed” in cells
 - Each cell contains a whole genome (complete instructions)
- **Genes represent our “Nature”**

Genetics

- **Spengler et al 2009**

- Studied 5-HTT serotonin transporter gene
- This gene has naturally occurring variations (alleles) with shorter and longer length
- Shorter “allele” combinations resulted in risk of insecure attachment
- Longer “allele” combinations were “protective”

- **Genes represent our “Nature”**

Epigenetics

- Epigenetics – the study of the gene (Nature) as effected by the environment (Nurture)
- Gene expression can be modified by experience without changing the actual gene
 - Transcription “turned off” by attachment of methyl groups (methylation)
 - Transcription also blocked by folding around histones
 - Allows cells to differentiate (change in function) and genes themselves to “learn

Epigenetic Learning

■ Meaney, 2006

- Traumatized mother rats groomed their pups differently
- Their pups grew up anxious hyperresponsive
- Different methylation patterns seen on corticotropin receptor gene
- Uncouples negative feedback



Epigenetic Learning

■ Murgatroyd, 2009

- Early repeated separation of pups from mother mice
- They developed poor coping, decreased memory
- Decreased methylation of the regulatory region of the AVP (neuropeptide) gene
- Results is sustained HPA hyperactivity



Epigenetic Learning

- **Brunton, Donadio, Russell, 2011**

- Female mice stressed during late gestation

- Male offspring more anxious as adults

- Females not affected

- Prenatal stress permanently altered CRH receptor genes in the amygdala



Epigenetics

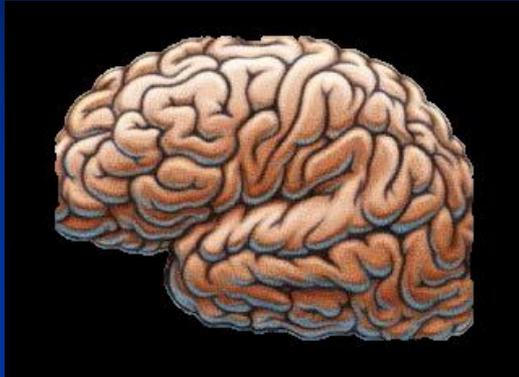
- **Binder et al, JAMA 2008**
 - Gene polymorphism (5-HTTLR)
plus child abuse = PTSD
- **Szyf & Meaney, Pub Lib of Science, 2008**
 - Suicides shared DNA methylation of 5-HTT
 - All were child abuse survivors
 - Affects protein synthesis in feedback loop
 - Results in HPA dysregulation



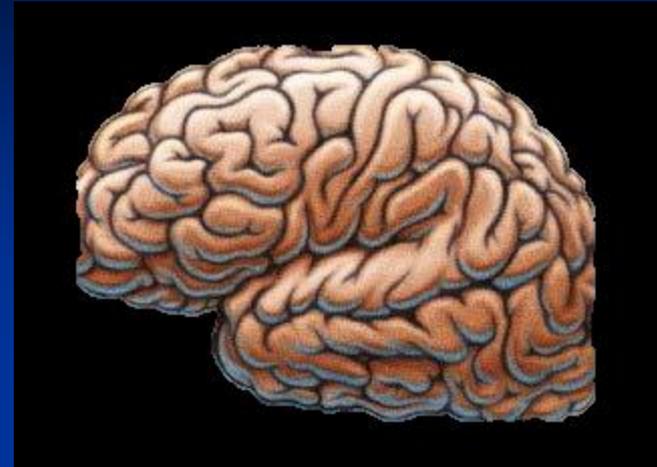
SYSTEM- Neuroendocrine



Why Early Experiences Matter



Newborn Brain
Average Weight
333 grams



2 Year Old's Brain
Average Weight
999 grams

**Average adult brain
weighs only 250 – 350 grams
more than a 2 year old's brain**

How does the brain grow?

- You are born with all the neurons or “nerve cells” you will ever have
- Neurons “grow” by increasing the connections
 - Adding additional axons and dendrites (wiring)
 - Simulated connections grow, unused are cut off
- Myelination increases
 - Specialized cells that act as insulation
- Increasing number of glial cells and blood vessels
 - To create structural support, supply lines to the neurons

Childhood Trauma Alters Brain Development

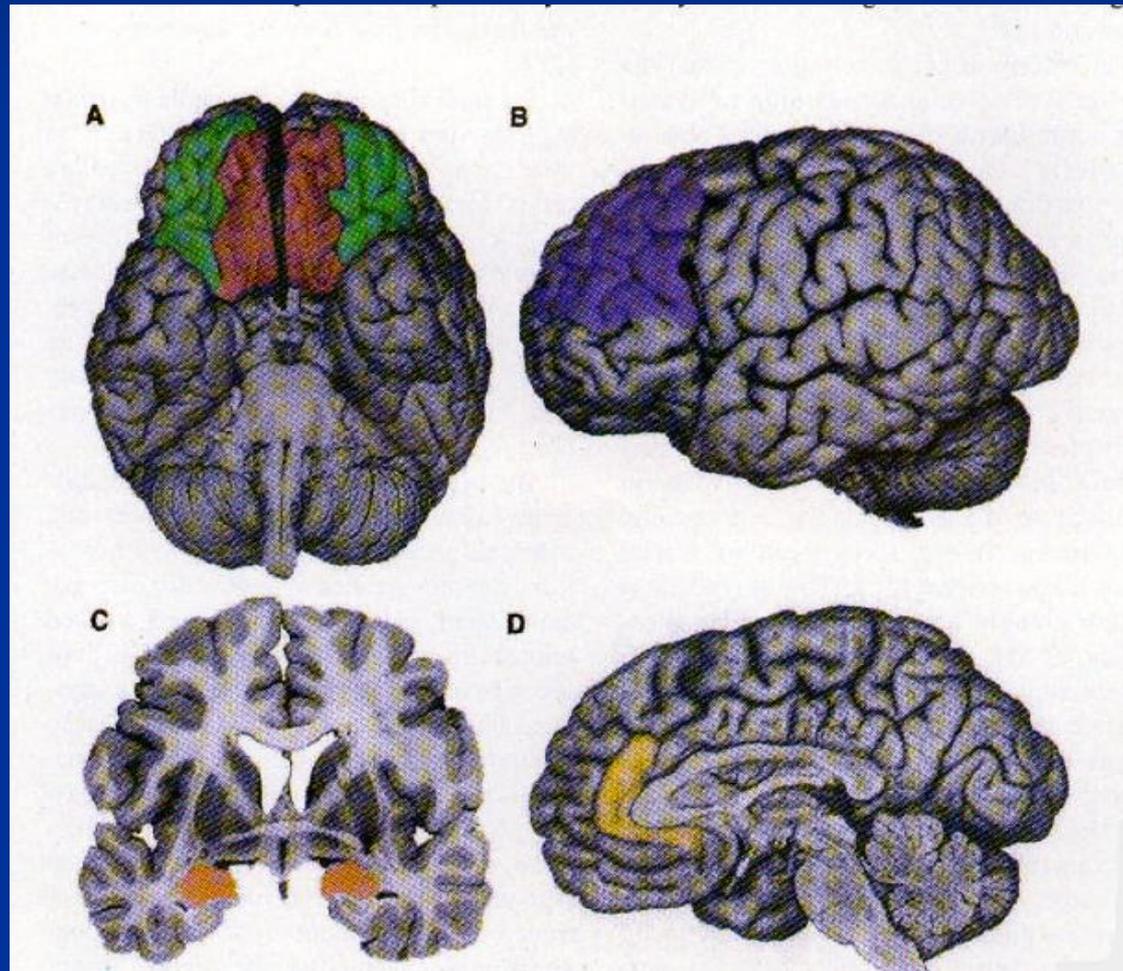
- Maltreated children have smaller brains for body size than normal children
- Brain regions reduced in size in maltreated children (anterior cingulate, corpus callosum, prefrontal cortex)
- Trauma effects on the brain appear to be the greater for boys than girls

Trauma impacts key structures underlying emotional regulation

Ventral prefrontal cortex

Dorsolateral cortex

Orbital prefrontal cortex



Amygdala

Corpus Callosum

Anterior cingulate

Fight or Flight Response

Saliva
flow decreases

Eyes
pupils dilate

Skin
blood vessels constrict;
chills and sweating

Lungs
quick, deep
breathing

Heart
beats faster
and harder

Bowels
food movement
slows down

Stomach
output of digestive
enzymes decreases

Blood vessels
blood pressure
increases as
major vessels dilate

Muscles
become more
tense; trembling
can occur



Fight or flight



Neuroendocrinology



STRESS



Hypothalamic / pituitary stimulation



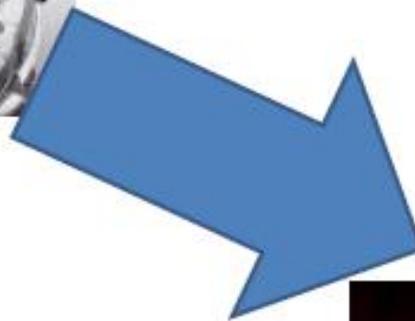
Adrenal cortisol release



Feedback



Acute or Chronic



SYSTEM – Social/Behavioral



Goals of development

- Attachment
- Regulation
- Cognition

Attachment needs

- Caregiver needs to be
 - Present when needed
 - Consistent (enough)
 - Prompt (enough)

- So the child can feel
 - Valuable
 - Optimistic

“The Contingent Co-Regulatory Dance”

- Stanley Greenspan, 2001



“Serve and return”

- Garner, 2013

Maltreated kids may have

- Persistent fear/alert state
- Poor differentiation of affect
- Dysregulation of affect
- Distrust of others

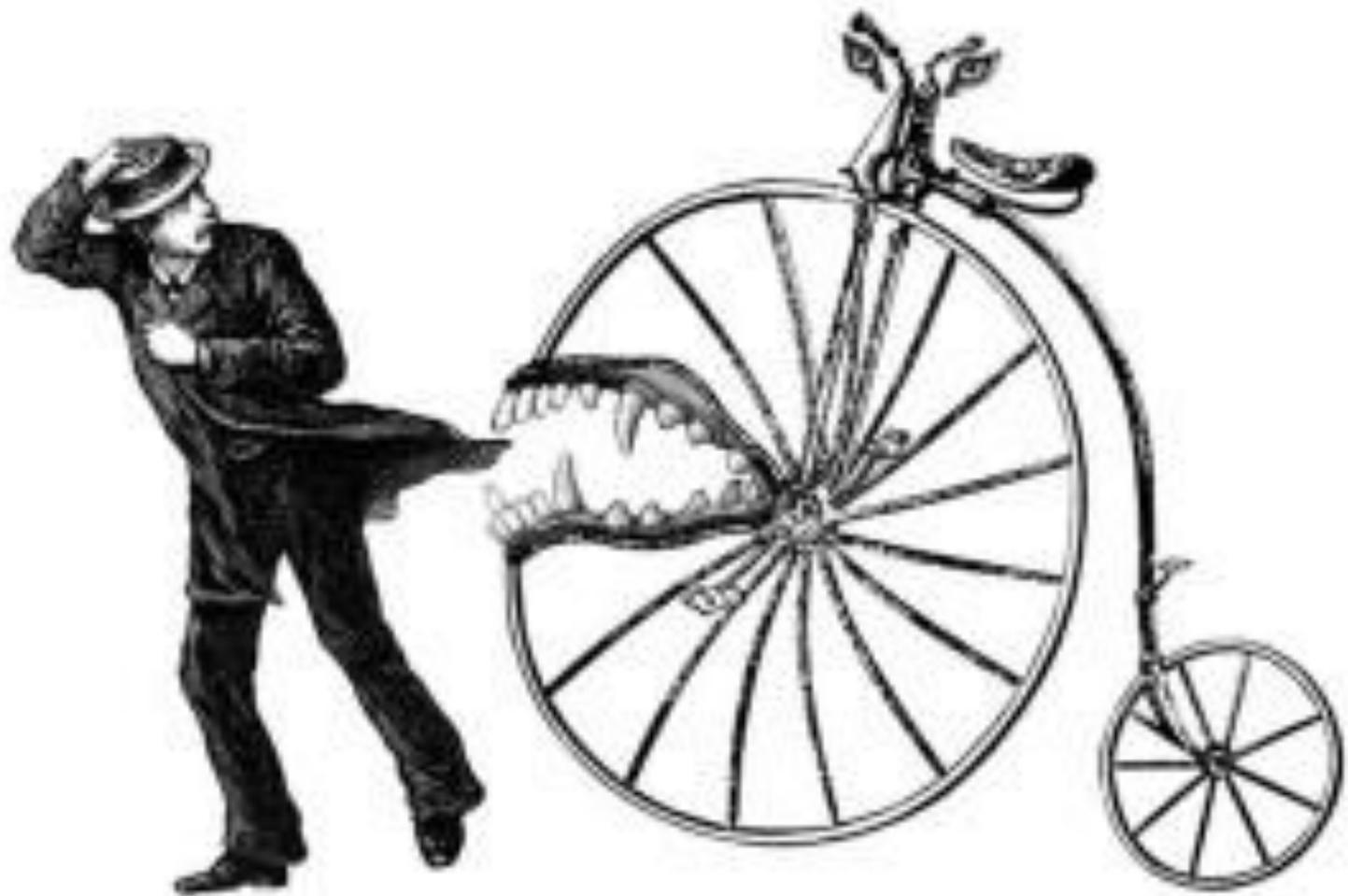
... and thus may be hard to parent

Physically abused children see anger where others see fear



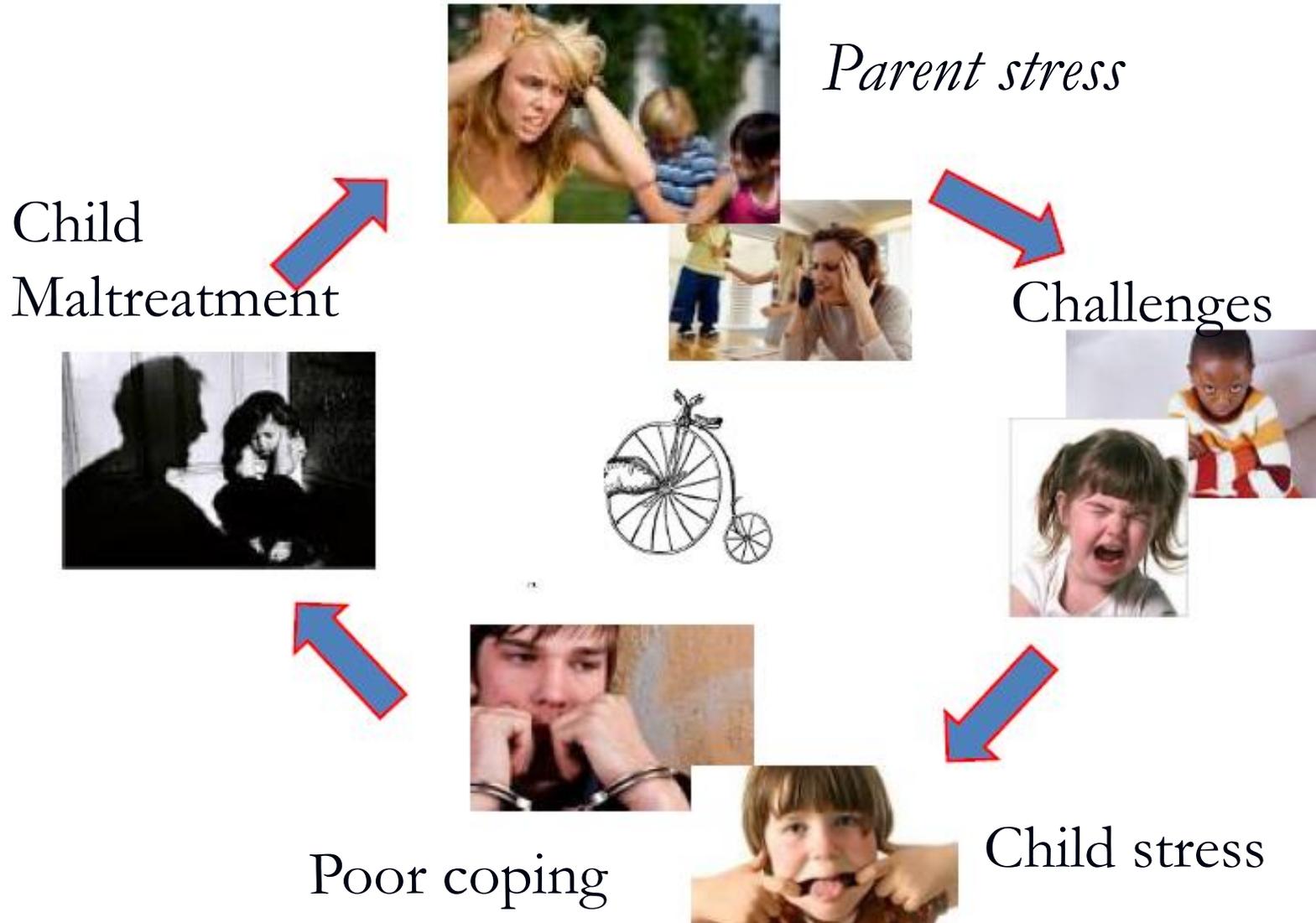
Social & Emotional Deficits in Maltreated Children

- Maltreated children have lower social competence
- Have less empathy for others
- Have difficulty in recognizing other's emotions
- Are less able to recognize their own emotional states
- Are more likely to be insecurely attached to their parents



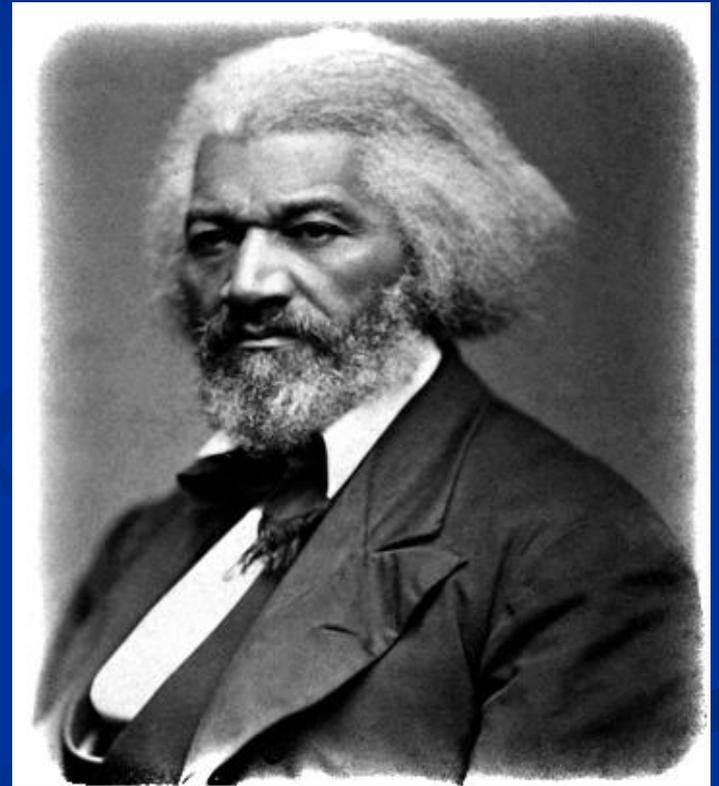
A VICIOUS CYCLE

A vicious cycle



It is easier to build
strong children
than to repair
broken men.

Frederick Douglass



Interventions

For every problem there is a
solution that is simple, direct
...and wrong.

H. L. Mencken



Potential System Interventions

■ Molecular

- Better prenatal care (IPV, mental health, drugs)
- Genetic/epigenetic screening (?)
- Methylation blockers (?)

■ Neuroendocrine

- Alter neurotransmitters
- Block stress response

■ Behavioral

- Evidence-based interactive therapies

What we see

- Attention – Deficit Hyperactivity Disorder
- Oppositional Defiant Disorder
- Major Depression or Bipolar Disorder
- Reactive Attachment Disorder
- Conduct Disorder
- Anger Management Problems
- Complex PTSD
- Autism Spectrum Disorder
- Developmental Delay

Response to Trauma: Behaviors

Category	More common with	Response	Misidentified as and/or co-morbid with
Dissociation (Dopaminergic)	<ul style="list-style-type: none">-Females-Young children-Ongoing trauma	<ul style="list-style-type: none">-Detachment-Numbing-Compliance-Fantasy	<ul style="list-style-type: none">-Depression-ADHD – inattentive type-DD
Arousal (Adrenergic)	<ul style="list-style-type: none">-Males-Older children- Witness to violence	<ul style="list-style-type: none">-Hypervigilance-Aggression-Anxiety-Exaggerated response	<ul style="list-style-type: none">-ADHD-ODD-CD-Bipolar disorder-Anger management difficulties

Identifying Trauma

Bodily functions response to trauma

Sleep	Stimulation of reticular activating system	<ol style="list-style-type: none">1. Difficulty falling asleep2. Difficulty staying asleep3. Nightmares
Eating	Inhibition of satiety center, anxiety	<ol style="list-style-type: none">1. Rapid eating2. Lack of satiety3. Food hoarding4. Loss of appetite
Toileting	Increased sympathetic tone, increased catecholamines	<ol style="list-style-type: none">1. Constipation2. Encopresis3. Enuresis4. Regression of toileting skills

What do caretakers need to know?

Kids who have lived with toxic stress may have:

- “Hair trigger” emotional responses
- Difficulty regulating their arousal
- Reluctance to turn to others for help (trust)
- Inability to discuss their emotional feelings
- Insecurity over food, safety, or relationships

... and thus may be hard to parent

The Bear is always there!



What do YOU need to know?

- What do the caretakers see as the problem?
 - Preconceptions, fears
- What experiences have they had?
 - Strengths, weaknesses
- Who will be there to help them?
 - Sources of support

... begin by listening

What to teach caretakers?

- Learn to notice and avoid emotional “triggers”
- Allow control: Keep to routine, but give choices
- Don’t take behaviors personally
- Remain as calm, patient, logical as possible
 - lower tone and intensity of voice
- Acknowledge and respect the child’s feelings
- Give child words to label emotions
- Don’t expect quick results

Keys to Changing Behavior

- **Changing learned behaviors takes time**
 - The more the child sees a behavior as protective, the harder it is to change
- **Keep the lesson simple and logical**
- **Praise positive and even neutral behavior**
- **Discipline is not the same as punishment**
 - Strengths, weaknesses
- **Anger**
 - Can trigger threat/safety response making learning difficult

Children are doing the best they can!

- Caretakers job is to teach them how to adapt to our world
- Our job is to support the caretakers as teachers
- If we're both patient and persistent, and listen to each other, we can help make the transition successful



Behavioral Therapy for Traumatized Child

- **PCIT** Parent Child Interaction Therapy
- **CPP** Child Parent Psychotherapy
- **TF-CBT** Trauma Focused Cognitive Behavioral Therapy
- **CBITS** Corrective Behavioral Intervention for Trauma in Schools
- **ARC** Attachment Self Regulation and Competency

* Require active caretaker



Psychopharmacology

NSCAW II data 2008-2010

- Of children in out-of-home, non relative care 29.1 % were taking one or more medications and 13% were taking three or more psychotropic medications
- Too much or too little?



Using Psychotropic Medications

- There can be value in controlling symptoms
- Medication is one part of a comprehensive plan
- A full “brain health” evaluation includes
 - Family and social history
 - Behavioral observations from all involved
 - A review of all existing health information
- Treatment should be consistent with the MH diagnosis
 - Start low, go slow & monitor closely
 - Reevaluate on a regular basis



The bottom line...

- Understanding the origins of maladaptive behaviors can guide effective interventions
- Interventions may target social/behavioral, neuroendocrine, or (epi)genetic systems, but
ALL are eventually affected
- We can only treat children by proxy
 - Caregivers must be involved
- Preventions programs such as
Home Visitation and Parenting Education are also essential



We are guilty of many errors and many faults,
but our worst crime is abandoning the
children, neglecting the fountain of life.
Many of the things we need can wait.
The child cannot. Right now is the time his
bones are being formed, his blood is being
made, and his senses are being developed.
To him we cannot answer 'Tomorrow'-
his name is Today.

Gabriela Mistral

Chilean poet, Nobel Prize 1945



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